

**REMARKS/ARGUMENTS**

Claim 29 is amended to clarify antecedent basis, which amendment should not affect the scope of the claim.

*Election of Species with Traverse*

Applicants traverse the Requirement for Restriction. Applicants provisionally elect for prosecution on the merits the embodiment of a receiver apparatus or method for digital signals of a prescribed baud rate transmitted by respective AM RF carriers through a medium subject to multipath distortion, which embodiment is illustrated by FIGURES 10 and 11 of the application drawing. This is believed to correspond with the third embodiment discerned by the Examiner.

The Examiner indicates that claims 46-48 correspond to the third embodiment of applicants' invention he discerns. The Examiner's attention is drawn to linking claim 48. Besides claims 46-48, generic claims 29 and 52 apply to the provisionally elected embodiment of applicants' invention, applicants point out. So do claims 30-32 and 53. Accordingly, at least claims 29-32, 46-48 and 52-53 should be examined on the merits.

The Examiner indicates that claims 24-26, 29-41 and 52-54 correspond to the first embodiment of applicants' invention that he discerns. Claims 42-44, directed to particulars of receivers using baseband equalization, provide details of the construction of the first embodiment discerned by the Examiner. Accordingly, applicants believe that claims 42-44 also are properly grouped together with claims 24-26, 29-41 and 52-54. Per MPEP 809, linking claim 48 would also have to be grouped with claims 24-26, 29-44 and 52-54 for examination.

The Examiner indicates that claims 27-41 and 52-54 correspond to the second embodiment of applicants' invention that he discerns. Claim 45, directed to particulars of a receiver using passband equalization, provides details of the construction of the second embodiment discerned by the Examiner. Accordingly, applicants believe that claim 45 also is properly grouped together with claims 27-41 and 52-54. Per MPEP 809, linking claim 51 would also have to be grouped with claims 27-41, 45 and 52-54 for examination.

The Examiner indicates that claims 49-51 correspond to the fourth embodiment of applicants' invention that he discerns. The Examiner's attention is drawn to linking claim 51. Generic claims 29 and 52 also apply to the fourth embodiment of applicants' invention illustrated in FIGURES 12 and 13 of their drawing, applicants point out. So do claims 30, 31 and 53.

Claims 24-26 directed to the first embodiment prescribe baseband equalization, while Claims 27 & 28 directed to the second embodiment prescribe passband equalization. In baseband equalization the equalization filtering succeeds the demodulator or synchrodyne circuitry; in passband equalization the equalization filtering precedes the demodulator or synchrodyne circuitry. The third and fourth embodiments of the invention discerned by the Examiner differ from each other essentially in that the third embodiment employs baseband equalization and the fourth embodiment employs passband equalization.

Applicants for patents in the electronics arts are faced with the problem that the Doctrine of Equivalents has recently been crippled by the courts. So, effective patent protection requires the description and claiming of design variants readily thought of by those skilled in the art and acquainted with applicants inventions. U.S. patent No. 6,124,898 issued 26 September 2000 to C. B. Patel and A. L. R. Limberg, entitled "DIGITAL TELEVISION RECEIVER WITH EQUALIZATION PERFORMED ON DIGITAL INTERMEDIATE-FREQUENCY SIGNALS" is evidence directly on point that, at the time application serial No. 09/823,500 was filed, passband equalization was known to the DTV art to be an alternative to baseband equalization. Applicants decline to argue that Claims 27 & 28 are patentable over Claims 24-26, inasmuch as this could subject Claims 27 & 28 to an obviousness-type double-patenting rejection based on U.S. patent No. 6,124,898, if there is no decision that common grounds for patentability are found in the two sets of claims.

Neither applicant makes any claim in this application to having invented adaptive baseband equalization per se or to having invented adaptive passband equalization per se. The Examiner seeks admission by the applicants that one of these forms of equalization is obvious from the other. At the time applicants filed their application there was public knowledge of adaptive baseband equalization per se and adaptive passband equalization per se, and they were recognized as alternative forms of adaptive equalization with respective advantages and disadvantages. Consequently, it is unclear to

applicants how the obviousness of one of these forms of adaptive equalization over the other is in issue in this application. Obviousness would become an issue only if anticipation of a particular form of adaptive equalization could not be shown.

The Examiner's selection of embodiments and his demand for admissions concerning the patentability of one over the other indicate that the Requirement for Restriction was based on the assumption that patentability is primarily based on the arrangement of processing 8VSB signals. This assumption contains substantial error, and the Requirement for Restriction is traversed for being based on a faulty presumption as to the issues of patentability of the claims currently active in the application.

Applicants' SUMMARY OF INVENTION indicates their equalization techniques to be novel in that "the system characteristic of the adaptive filtering is calculated from the discrete Fourier transform of the input signal supplied to the adaptive filtering and from the discrete Fourier transform of the transmitted signal as estimated in the receiver". See page 12, lines 9-11, of the application. It is not the arrangement of processing 8VSB signals that is the primary basis for patentability of most of the claims, but rather the manner in which the weighting coefficients for the adaptive channel-equalization filters are computed.

Patentability in both the first and second embodiments of the invention is predicated on the non-obviousness of the weighting coefficients for equalization filtering being determined by DFT methods applied to ordinary data in 8VSB signals. This is basis for applicants traversing restriction between the first and second embodiments of their invention discerned by the Examiner. Patentability of linking claims 48 and 51 in the third and fourth embodiments is predicated on the non-obviousness of the weighting coefficients for equalization filtering being determined by DFT methods applied to ordinary data in 8VSB signals. This is the basis for applicants' opinion that MPEP 809 requires that linking claim 48 be grouped together with claims 24-26, 29-44 and 52-54 for examination. This is also the basis for applicants' opinion that MPEP 809 requires that linking claim 51 be grouped together with claims 27-41, 45 and 52-54 for examination.

Patentability in both the third and fourth embodiments of the invention is predicated on the non-obviousness of two inventions that are related to each other. One invention is the weighting coefficients for equalization filtering being determined by DFT methods applied to ordinary data in

8VSB signals. The other invention concerns improvement in equalization resulting from demodulation at demodulation axes other than the in-phase and quadrature-phase demodulation axes. This is basis for applicants traversing restriction between the third and fourth embodiments of their invention discerned by the Examiner.

At the time applicants filed their application they knew that DTV receiver designers were using time-domain channel-equalization filters, but applicants had no knowledge that anyone had contemplated using frequency-domain channel-equalization filters. Applicants' subsequently filed prior-art statement and previous responses have established that frequency-domain channel-equalization filters *per se* were known in the digital communications art. Applicants presumed that frequency-domain channel-equalization filters could have been considered by DTV receiver designers when attempting to solve channel-equalization problems. Applicants narrowed their claims accordingly. Applicants' action in this regard is further indication that they view the primary thrust of invention in most of the active claims listed in their response to the first Office Action to be the manner in which the weighting coefficients for the adaptive channel-equalization filters are computed. This, rather than in the arrangement of channel-equalization filtering relative to the demodulator.

Apparatus claim 29 claims in broad terms receivers having channel-equalization filtering the weighting coefficients of which are determined by DFT methods applied to ordinary data in 8VSB signals. Claim 29 is generic to at least some of the claims directed to each of the embodiments of the invention. Method claim 52 claims in broad terms the weighting coefficients for equalization filtering being determined by DFT methods applied to ordinary data in 8VSB signals. Claim 52 is generic to at least some of the claims directed to each of the embodiments of the invention. All four embodiments of the invention share a common issue as to patentability, which is whether or not, at the time applicants made their invention, using DFT methods on ordinary 8VSB signals to determine the weighting coefficients for equalization filtering was obvious. That is, obvious to one who was of average skill in the DTV art and was fully acquainted with the relevant prior art. Where there is a common specific issue as to patentability, there is unity of invention, and the principle of one patent for one invention that the courts have found 35 USC 101 to mandate should apply.

Claims 46-48 directed to the third embodiment prescribe baseband equalization for demodulation at demodulation axes other than the in-phase and quadrature-phase demodulation axes used in the first embodiment. Claims 49-51 directed to the fourth embodiment prescribe passband equalization for demodulation at demodulation axes other than the in-phase and quadrature-phase demodulation axes as in the second embodiment. Demodulation at these other axes shifted  $45^\circ$  from the in-phase and quadrature-phase demodulation axes is believed novel, based on search of U.S. patents made by applicant Limberg. Demodulation at axes shifted  $45^\circ$  from the in-phase and quadrature-phase demodulation axes is preferable for complex equalization, no matter the way in which the channel-equalization filtering is adapted, since the number of multipliers required is half the number required for in-phase and quadrature-phase demodulation axes. The dynamic range of the equalization filtering is increased 40% since both complex-signal-component filters carry substantial signal, instead of just one as is the case with conventional complex equalization.

Demodulation at axes shifted  $45^\circ$  from the in-phase and quadrature-phase demodulation axes is specifically preferable for applying DFT to ordinary 8VSB data since both components of complex demodulated signal, rather than just one, have sufficient energy to rise above attendant noise when carrier phase-lock is achieved. Accordingly, noise has reduced effect on complex DFT computations based on ordinary 8VSB signals. These effects are alluded to in the paragraph bridging pages 34 and 35 of the specification. The invention of demodulation at axes shifted  $45^\circ$  from the in-phase and quadrature-phase demodulation axes is *related* to the invention of performing DFT computations based on ordinary 8VSB signals. Together they provide better performance than can be obtained without the shift in demodulation axes.

Applicants have a positive duty to disclose the preferred embodiments of their invention, and the *quid pro quo* for complete disclosure should be protection of both of the non-obvious inventive aspects that the preferred embodiments of the invention set forth in claims 49 and 51 share. Restriction practice that not only tolerates, but encourages less than a full examination of all issues of patentability concerning preferred embodiments of applicants' invention appears faulty and inequitable. Where there are *related* inventions in the preferred embodiments of their invention, examining just one of the inventions is usually not accepted practice, as MPEP 808.02 discloses.

Patents sound in equity, and applicants should be able to claim less-preferred of their invention as well those preferred embodiments within the same patent. It is inequitable to allow others to eliminate one of the two non-obvious inventive aspects the preferred embodiments of the invention set forth in claims 49 and 51 share and escape infringement of applicants' claims while enjoying benefits of applicants' invention. Case law indicates that the obviousness or non-obviousness of invention should be determined from consideration of the claimed subject matter considered as a whole, rather than from the obviousness or non-obviousness of each component of the claimed subject matter as dissected from the whole.

Demodulation at axes shifted  $45^\circ$  from the in-phase and quadrature-phase demodulation axes is a *related* invention to using DFT methods on ordinary 8VSB signals to determine the weighting coefficients for equalization filtering. So the Examiner must establish reasons for insisting on restriction amongst the claims, which reasons meet the criteria set forth in MPEP 808.02. The Examiner has not established that equalizers are classified for search according to the axes of demodulation of the signal being subjected to channel-equalization, per criterion A of MPEP 808.02 for supporting restriction. It appears from the record that applicants were the first to expend effort on changing the axes of demodulation from the customary in-phase and quadrature demodulation axes in order to gain inventive advantage. Therefore, criterion B of MPEP 808.02 for supporting restriction is not satisfied. The Examiner has made no showing that the two aspects of invention were already recognized as separate subjects for inventive endeavor. There is no appreciable difference in the field of search in regard to the two aspects of invention; both concern the rather narrow field of channel-equalization filtering. So, criterion C of MPEP 808.02 for supporting restriction is not satisfied. Simply put, there is no prior basis for finding the third and fourth embodiments to be independent of the first and second embodiments, respectively. It is an aspect of applicants' invention in regard to its preferred embodiments that is offered as a basis for restriction, which is impermissible restriction practice. The proper basis for restriction is that the inventions must be separate and distinct from each other as judged by criteria already established in the prior art. MPEP 808.02 discloses that this is so, at least absent any clear indication that separate classification is planned. Incidentally, the concern about classification seems excessive and not very logical, since it is an easy matter to include a patent within more than one classification.

As is often the case when related inventions are concerned, the Requirement for Restriction can pose obviousness-type double patenting issues. The several-year delay in the USPTO before presenting such requirement imposes an inequitable burden on applicants if and when such issues arise. At this time it is not readily apparent to applicants what basis there would be for finding the first, second and fourth embodiments non-obvious over the third embodiment. Unless there are grounds for the Examiner to be reasonably sure that there is such basis, the Requirement for Restriction should be withdrawn.

*Comments concerning Non-obviousness of the Generic Claims*

As already noted, claim 52 claims in broad terms the weighting coefficients for equalization filtering being determined by DFT methods applied to ordinary data in 8VSB signals. Claim 29 broadly claims a receiver with equalization filter adapted by such methods. Applicants believe procedures using DFT methods on ordinary 8VSB signals to determine the weighting coefficients for equalization filtering are novel. Applicants' novel procedures replace the incremental adjustment procedures using LMS-gradient methods previously used in DTV receivers, the RLS methods proposed for DTV receivers, or the FTF methods proposed for DTV receivers. Applicants' novel procedures are quite clearly not obvious from LMS-gradient, RLS or FTF methods.

The novel procedures using DFT methods to determine the weighting coefficients for equalization filtering from **ordinary 8VSB signals** differ from prior-art DFT methods to determine the weighting coefficients for equalization filtering from **special training signals**. DFT methods to determine the weighting coefficients for DTV equalization filtering from special training signals were described by applicant Limberg in U.S. patent No. 6,816,204 filed 19 January 2001, issued 9 November 2004 and entitled "GHOST CANCELLATION REFERENCE SIGNALS FOR BROADCAST DIGITAL TELEVISION SIGNAL RECEIVERS AND RECEIVERS FOR UTILIZING THEM". DFT methods to determine the weighting coefficients for DTV equalization filtering from special training signals were further described by applicants and C. B. Patel in U.S. patent No. 6,768,517 filed 11 July 2001, issued 27 July 2004 and entitled "REPETITIVE-PN1023-SEQUENCE ECHO-CANCELLATION REFERENCE SIGNAL FOR SINGLE-CARRIER DIGITAL TELEVISION BROADCAST SYSTEMS".

Using DFT methods to determine the weighting coefficients for equalization filtering from ordinary 8VSB signals is non-obvious, applicants believe. U. S. patent No. 5,065,242 (Dietrich *et al.*), of record, made clear that DFT methods for determining the weighting coefficients for ghost-suppression (echo-suppression) filtering were successful, proceeding from special echo-suppression reference signals composed of cyclically repetitive binary pseudo-random-noise sequences. The cyclical repetition of PN sequences was previously used to suppress so-called "edge phenomena" that are apt to cause substantial error in DFT methods for determining the weighting coefficients for channel-equalization (echo-suppression) filtering. The prior art already of record furnishes evidence of what persons skilled in the art of using DFT methods for determining the weighting coefficients for equalization filtering believed at the time the inventions now under examination were made. There were grounds for persons of ordinary skill acquainted with the prior art of using DFT methods for determining the weighting coefficients for equalization filtering to presume that echo-suppression reference signals of special design were necessary for DFT methods to be employed successfully. U.S. patents No. 6,816,204 and No. 6,768,517 used cyclical repetition of PN511 and PN1023 sequences that incorporated data-segment sync sequences.

The invention was partly based on observation that DFT methods to determine the weighting coefficients for equalization filtering from ordinary 8VSB signals might be possible because the data randomization procedure tends to generate symbol sequences with a substantial amount of variation. This might allow ghosts or echoes of the symbol sequences to be distinguished from other groups of symbols. Furthermore, there is not much repetitive pattern except for the regularly repeated data-segment sync sequences and for the triple PN63 sequences in the initial segments of data fields. It was perceived that the spacings between the regularly repeated data-segment sync sequences were large enough that their repetition would not be of much concern with regard to the DTV receiver characterizing the channel. Applicants discerned also that averaging coefficient determinations using lowpass filtering could be utilized to make the adaptation of the channel-equalization filter less dependent on anomalies of individual DFT computations based on ordinary 8VSB signals.

The invention was partly based on the insight that if DFT methods were used on symbol sequences substantially longer than employed in the prior art, the errors owing to "edge phenomena" would be diluted. Repetition of PN sequences was the only mechanism for suppressing the errors



owing to "edge phenomena" in determining the DFT of the received channel that was known in the prior art, insofar as applicants are aware.

Such observations and insight were insufficient of themselves to ascertain whether DFT methods to determine the weighting coefficients for channel-equalization filtering from ordinary 8VSB signals would be successful. At most, such observations and insight provided nothing more than a suggestion to try, a suggestion formulated from consideration of the problem at hand rather than from the work of others. The actual utility of the methods could only be guessed at, even by DFT experts. Computer simulations by one of the applicants not only confirmed the suspicion that DFT methods could be used to determine the weighting coefficients for equalization filtering from ordinary 8VSB signals. The results were surprisingly good for sequences of only a few thousand symbols, good enough to be used in a DTV receiver that would be commercially competitive at the time of the invention.

The invention rejected conventional wisdom in the prior art, which taught using DFT processes on special echo-suppression reference signals and so taught away from altering the DFT processes to use symbol sequences from ordinary 8VSB signals. There is no evidence in the record of an enabling suggestion to make such alteration, let alone any suggestion that such alteration would likely produce a successful result having practical utility. The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. [Citations omitted.] Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529, 1531 (CA FC 1988).

The claims are directed to a non-obvious alteration of the process itself, rather than finding the optimum value of a result effective parameter, so the rule of the *Aller* case does not apply. In *In re Aller*, 42 CCPA 824, 220 F.2d 454, 105 USPQ 233, the court set out the rule that the discovery of an optimum value of a variable in a known process is normally obvious. CCPA has found exceptions to this rule when the results are unexpectedly good. *In re Waymouth*, 499 F.2d 1273, 182 USPQ 290 (CCPA 1974). In any case, there is nothing in the prior art of record to indicate that the length of the symbol sequence was recognized before the invention to be a result effective

variable insofar as overcoming the errors caused by "edge phenomena", so the invention can have practical utility. An exception to the rule that discovery of the optimum value of a variable in a known process is normally obvious occurs when the parameter was not recognized to be a result effective variable. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977).

The aspects of the third and fourth embodiments of the invention concerning demodulation at axes shifted 45° from the in-phase and quadrature-phase demodulation axes appear from the current record to be clearly non-obvious. It is not such demodulation *per se* that constitutes the invention, but the simplification of the complex-equalization filter structure that such demodulation permits. There can be a halving of the substantial number of multipliers required. An inventor may obtain a patent for a combination even though it produces the same result as other devices, if it produces such result with fewer elements than have been used or thought necessary. *Glade v. Walgreen Co. et al.*, 50 USPQ 407- 122 F.2d 306 (CCA 7th Ct) - Writ of Certiorari denied Dec. 8, 1941.

#### *Conclusion*

(941)-743-4891 is a temporary telephone number for the undersigned applicant while his home and office, damaged in Hurricane Charley, is being reconstructed. Sometime late in May or in early June the phone number for the undersigned applicant will again be (941)-624-4302.

Respectfully submitted,



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Enclosures: Transmittal Form

Copy of U. S. patent No. 6,324,898